

DAWBARN (R.H.M.)

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OF
SPINAL RESECTION,

BY

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WITH NEUROLOGICAL NOTES,

BY

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A SUCCESSFUL CASE OF SPINAL RESECTION.*

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It gives me great pleasure to lay before this section of the Academy to-night, at the request of its chairman, Dr. Gray, the history of so rare and interesting a case as one in which excision of a portion of the spinal column was performed for the relief of paraplegia due to traumatism.

Trephining the spine, or resection by some other means, has been done so seldom that it can hardly be said to have a literature. I refer, of course, to the operations done since the days of antisepsis, since these alone have any statistical value for us. Most of the recorded cases, too, have been for the relief of some condition other than fracture. For example, of Macewen's six cases, reported some months since in the "Lancet," five were for relief of paraplegia due to a tumor, generally areolar in its nature, situated between theca and bone, and apparently starting from Pott's disease as an irritating cause. It is the more necessary, therefore, that this case should be reported somewhat in detail.

The history is as follows :

Mr. Harry S., twenty-nine years of age, unmarried ; occupation, superintendent at the new aqueduct works ; fell from a height of twelve to fifteen feet, on the last day of August, 1888, striking upon his back. He may have struck a wagon-wheel in his descent. He is not sure regarding this. Was unconscious for a time, and on awaking found himself completely without sensation or power of motion in the parts below the ribs. He was delirious for fifteen days thereafter, having considerable fever during this time.

* Read before the Section in Neurology of the New York Academy of Medicine, May 10, 1889.



A plaster splint was applied at once by his physician, Dr. C. S. Collins, of Sing Sing, who first moulded toward the median line two broken spinous processes which had been deflected toward the left; apparently these were the eleventh and twelfth dorsal. The latter spine, moreover, projected backward about two-thirds of an inch further than its fellows. This cast was left on for seven weeks. Then another was applied, and left on for two weeks. Thereafter the patient, now able to be lifted into a chair without much pain, wore a kind of corset, stiffened somewhat with corset-steels. During most of this period faradic electricity was used from time to time.

Dr. Collins brought his patient to this city and put him in my hands on December 20th. His condition then was as follows: Complete paraplegia, beginning a few inches below the ribs. Involuntary passage of feces; retention of urine with overflow. Apparently the lesion had involved the so-called lumbar enlargement. The back showed a kyphotic twelfth dorsal spinous process, as previously mentioned, and that of the eleventh was deflected to the left about one inch and somewhat flattened down. Otherwise the column seemed normal, save for some tenderness on light pressure over the fractured bones. A sacral bed-sore was present, also ammoniacal cystitis. The former was subsequently healed, although with difficulty. The latter yielded quite readily to dilute carbolic and benzoic-acid irrigations, two or three times daily.

I advised an immediate consultation, and Professor Seguin was called in, January 6th. He thought the spinal bones were very probably pressing on the cord; but, there being no reaction of degeneration, he considered the prognosis moderately good, if no such compression actually existed. Advised galvanism applied daily, also massage and strychnine, and said that if no decided improvement was noted within a period of from six weeks to two months he would certainly advocate cutting down upon the spine to remove a possible compressing force.

The largest-sized chloride-of-silver battery—fifty cells—being insufficient to cause contraction in some regions,

notably the muscles at the back of the thigh, I procured another galvanic battery of the same strength, connecting the two. The most obdurate muscles responded to eighty or ninety cells, with the cathode placed upon their nodal points. Reaction to the current was quite prompt when one of sufficient strength was used. The left leg and the right thigh required an especially large number of cells.

For nearly a month there was a steady though slow improvement in the electric response. The muscles felt harder. The patient regained voluntary control of one muscle on each side—the sartorius—but no more. Following this period of improvement was one in which for nearly a month the patient merely marked time, so to speak. In fact, it seemed that the muscles were gradually wasting; and this although the most thorough applications of electricity and massage were daily employed.

It was during this period that Professor Gray was called in consultation. After a most careful and painstaking examination of the case he made a diagnosis which agreed entirely with that previously pronounced by Professor Seguin.

Since the condition at this time was practically identical with that when Dr. Seguin saw the case, I shall refer you for certain details to Dr. Gray's report. He urged immediate interference, believing that the patient's only hope lay in surgical exploration without further delay.

Examination of Mr. S., made Feb. 8, 1889, by Dr. L. C. Gray.—"Facial muscles are normal, as are also all the cranial nerves. Optic nerves and the fundi normal. In the upper extremities tact, pain, muscular and temperature sensations were normally appreciated. The grasp of the right hand, tested by the dynamometer, was forty-four kilogrammes, that of the left hand being forty. Upon the cutaneous surface of the trunk no definite area of hyperæsthesia was detected. The tests regarding this point were so contradictory that no value could be attributed to them. The area of anæsthesia upward ceased at a line drawn just above the umbilicus. The deep reflexes were present and active. In the lower extremities the sensations of pain, tempera-

ture, and muscular movements were absolutely and entirely abolished. There was, however, a very slight and imperfect appreciation of tact over the toes and the front of the feet. The plantar and knee-jerk reflexes were lost. Cremasteric reflex was present, and especially active on the left side. In the right leg the only muscle that reacted to the strongest faradaic current was the sartorius, and this reaction was fibrillary; in the same muscle no contraction could be obtained by galvanic currents running up to twenty-five and thirty milliamperes. There were no polar changes. The anterior tibial and peronei muscles reacted feebly to moderate faradaic and galvanic currents, without polar change. In the left leg the strongest faradaic and galvanic currents failed to produce any reaction in the thigh and buttocks. In the anterior and posterior leg groups there was no faradaic reaction. Thirty milliamperes of the galvanic current produced a feeble cathodal closing contraction in the anterior tibial, but only produced a slight flicker in the posterior tibial; even in these there were no polar changes. There was no anodal or cathodal contraction."

During the time subsequent to Dr. Seguin's visit I had, in anticipation of the probable necessity, practiced resection of the spine in my operative-surgery course at the Polyclinic upon six or seven cadavera.

It has happened that all of the few traumatic cases of spinal resection recorded hitherto, or at least those of which I have seen reports, were done at a point higher in the spine than the dorsi-lumbar junction. I quickly found that the incision heretofore recommended—a single, vertical, and generally central stroke—while permitting easy separation and retraction of the muscles from the spines and laminae in the cervical and upper dorsal region, where the muscles are comparatively thin, was not so satisfactory low down. The dorsal spinous processes near the lumbar verbræ no longer dip sharply downward but project backward; and the muscle filling the spaces here between these spines and the transverse processes is suprisingly thick to one who has not removed the lower part of the cord at autopsies.

Still, if we are to use the rongeur forceps, as is commonly done, gnawing away *piecemeal* the offending bones, the *central* incision must remain the best. If, however, we wish to *saw* through the laminae, removing them *entire* with their spinous processes, then the *lateral* incision, about to be described, is decidedly the preferable one—easier for the surgeon and safer for the patient, because involving less muscular detachment.

In this instance I determined to make an attempt which I believe is new of application to the spinal bones. I refer to reimplanting the detached portions of the column should it be shown at the operation that these are not lying in contact with the cord.

This idea rendered the central incision running down the spines still further objectionable. If the bones were by this usual method entirely bared of muscular attachment at the back, such bones, when cut away, might as a possibility, if kept aseptic and warm, reunite and live when replaced, just as the button removed when trephining the skull will frequently do. But, considering their size, this would be unlikely. And if chipped into small fragments, as advocated by Macewen in skull-trephining, the great difficulty of keeping such fragments absolutely quiet, even with the patient in a plaster jacket, will at once appear to every one. Upon the skull such absolute immobility can of course easily be secured.

As the best means of attaining my object I determined upon an incision which I will call the "H" incision. This runs like a capital H down the back, with a vertical stroke on either side the spine, and a transverse stroke placed opposite to, above, or below the middle of the vertical, as may seem best. The vertical strokes are directed, as they are deepened, obliquely inward toward the median line of the body and strike the bones about the middle of the laminae. This obliquity permits sawing the laminae with Hey's saw with much less retraction of the muscles and consequent laceration than otherwise. The muscles are separated by blunt means a sufficient distance at the bone-level to permit of sawing without laceration. Retractors

with an especially deep and flat traction surface are of course indispensable.

In sawing here one must direct the saw quite sharply inward. If the saw-cut is made at all parallel with the long axis of the spines, the canal will probably not be opened, but the teeth will advance into the body of the bone. This necessary obliquity of the saw-cut, too, prevents the reimplanted bone from sinking too far inward toward the cord, even under pressure. The saw-teeth should cut the narrowest possible groove. The laminae being severed over a sufficient number of vertebrae, with due care not to wound the theca, the next step is to make the transverse cut of the "H" between two of the spinous processes. This stroke is deepened obliquely upward, and of course cuts the supraspinous and interspinous ligaments.

Assuming that our transverse stroke is made low down in the "H," we now have a long superior flap of spinous processes and their laminae covered with their undisturbed muscular and cutaneous investments. Their vascular supply being so little interrupted, these bones are almost sure to live. This flap is now reflected, not *directly* upward nor (if the lower flap) *directly* downward—for the spinous processes coming mutually in contact will quickly prevent this—but *obliquely* upward, outward, and backward; or downward, outward, and backward, as the case may be. And in this way a perfectly free view of the theca and canal is easily obtained.

My intention was, in the case of my patient, to replace this bony flap should no part of it be found pressing on the cord, and by silver-wire or silkworm-gut sutures to fasten the laminae at a few points to their severed bases for additional security against motion in the fragments.

The operation upon Mr. S. was performed on the 27th day of February, 1889. Dr. Gray was present, and the writer was assisted by Dr. F. A. Manning, Dr. H. J. Kelly, Dr. H. J. Brower Browning, and Dr. R. M. Cramer. To the careful attention of these gentlemen during the subsequent difficult and tedious work the ultimate success was largely

due. Ether anæsthesia was used. The usual precautions were observed, which I need not detail here, to insure asepticism of the wound.

The patient lying in the left latero-prone position, the "H" incision was made. The vertical arms ran eight inches in length from the seventh dorsal to the second lumbar vertebra, slightly diverging as they descended. The transverse arm ran between the kyphotic spinous process of the twelfth dorsal and the first lumbar spine, which point was about two inches above the lower ends of the first incisions. (The accompanying figure, from a photograph, taken about two months and a half after the operation, will make this clearer, perhaps.) There was very little hæmorrhage. For the smaller vessels I would compress with sponges in one vertical arm for a time, meanwhile deepening the other; and *vice versa*. The sawing was made difficult because of the wide deviation of the eleventh spine toward the left. Of course I had to go still further to the left to saw its lamina on that side.

Extreme caution was necessary in order to avoid injury to the theca under the right lamina of this same vertebra. This right eleventh lamina was found crushed down much below the level of its fellows. Section of the arches of the eleventh and twelfth being finally completed, the twelfth was easily raised obliquely, together with its superjacent flap. It was now apparent that the depressed eleventh lamina was firmly adherent to the theca, and could not be moved. This fact, and a subsequent discovery as to the cord, compelled me to give up my original plan. In order to remove the depressed bone it became necessary to use the rongeur; and so firm was the thecal adhesion to the bone that, to separate it safely, it became necessary to saw and elevate the posterior arch of the tenth dorsal as well, thus stripping the adherent theca away partly from above and partly from below. The view of the cord now given caused any idea of reposition of the bones to be abandoned. About a finger's length of the cord (covered with its duramater, of course), was in sight. This formed a distinct knuckle, making an angle of perhaps 15° , its apex pointing

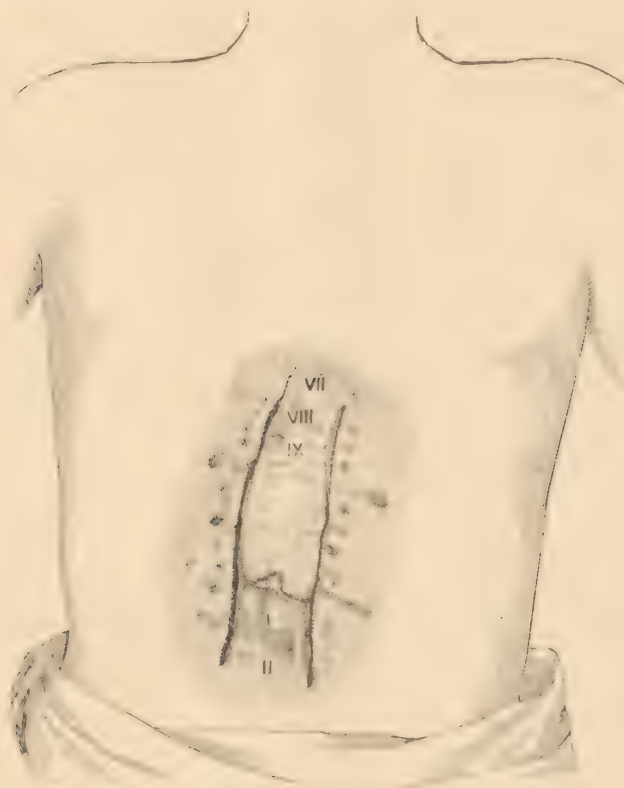
backward and lying immediately below the depressed arch. Evidently there had been a fracture of at least the twelfth dorsal, which had in part been thrown backward. The laminae and spine of this, the kyphotic vertebra, remained unbroken. The cord, then, was compressed between two abnormal bony points—one in front, one behind—or at least these points lay firmly in contact with the theca. And opposite the tenth and eleventh spines, while not compressed, it lay so closely in apposition with the arches that I thought it would be unwise to attempt to save these, as the width of the saw-cut would cause them to fall slightly nearer still to the cord.

The posterior arches of the tenth, eleventh, and twelfth were therefore dissected clean away from their muscular investment, with as little laceration of the latter as possible. The first lumbar arch proved normal, and consequently no lower flap in the "H" was made. The theca did not pulsate at all, and seemed adherent to the cord. Just below the eleventh lamina was evidence of an old transverse rupture of this sheath which had reunited, but with slightly overlapping edges. No break in the cord could be appreciated by the sight or the finger, and a curved probe passed at intervals gently beneath the theca could not find any bony point on the anterior wall pressing it—save the one named, which was not acute.

The writer would much have liked to open the dura mater and examine the state of the cord by actual sight, and would certainly have done so if the patient's condition had justified a further prolongation of the operation. But the pulse was failing, and, as anaesthesia had lasted more than three hours already, it was considered wisest not to explore further. Accordingly, the wound was closed with sutures of retention and of coaptation—both of catgut—and drained at the middle of the transverse arm of the "H." An ample and smooth iodoform- and bichloride-gauze was applied, then thick layers of cotton wadding about the body, and over all a stout plaster jacket going from the armpits to the trochanters. The patient reacted well. Unfortunately, the temperature of the hot bottles placed

about him was not carefully noted, although the attendants were cautioned; and several small sloughs on his thighs and feet resulted. These have since healed, as have two very large ones on his soles caused by heat injudiciously used a few weeks previously.

For some days after the operation he suffered from great pain in the wound, only being able to lie on his face with



any comfort at all. Although the temperature did not rise above $100^{\circ}+$ at any time, I made a trap-door in the splint the third day, and investigated. The wound was perfectly aseptic and well drained. Removal of the slight pressure upon it gave considerable relief. Briefly, the wound healed

by primary union save at the point of drainage, and this closed quickly upon removal of the tube. The pain ceased with the healing of the wound.

It is now ten weeks since the operation, and it will be interesting, perhaps, to give a summary of the changes in the patient's state at the present time. These may be epitomized by saying that he is none the worse in any respect for his operation, but, on the contrary, is in many ways somewhat improved, so that he expresses himself as very glad that it was performed.

The following points may be particularly noted :

Motion remains lost, save that the sartorii are under control and stronger than at any time since the fracture.

Reflexes—testicle, knee, and ankle—absent as before, but pricking the limbs causes free contractions and of other groups in addition to those irritated.

Muscular sense considerably improved.

Common sensation not much better in limbs. But patient can now feel a catheter the whole length of the urethra, can tell when the bladder is full or even nearly full, and can throw quite a vigorous stream. Before the operation the bladder showed no evidence of muscular power. This improvement has dated only from the past week.

Within three weeks after the operation rectal sensation and motion became strikingly better. While he still cannot retain feces, unless rather hard, he can now feel intestinal distension, and the finger introduced is grasped. Formerly, the rectum was completely paralyzed regarding both sensation and motion.

The improvement from which he derives the greatest comfort is present ability to move in any direction without pain. Until the operation any free motion of the head caused pain at the seat of fracture, and this region was quite sensitive to pressure. Now tenderness no longer exists here ; simply normal sensation.

Before the operation his muscles responded only to strong galvanic currents in the paralyzed area, and very poorly to faradaism. Now his muscles respond to electri-

city more easily and vigorously than ever before. Perhaps one-third fewer galvanic cells are needed now; but where formerly he hardly reacted at all to faradism, now he does so much more easily, much more vigorously, than to galvanism. This I believe is favorable.

His erections, although the penis has but little sensibility, are more frequent than formerly.

A striking improvement is in the temperature of his legs. They were often bluish, and frequently felt cold, but within a few hours after operation they became warm, and are now almost always so. The toes are no longer in a state of flexion, with the exception of the left great toe, the extensor of which is the only muscle that cannot be made to respond to electricity.

From the time of fracture the toe-nails of the left foot ceased to grow, although those of the right foot had to be cut several times between September 1st and the date of the operation. Since the resection the left toe-nails have grown vigorously, having required cutting more than once.

Dating from the injury the left leg ceased to sweat, although the right one did so whenever the patient was in a sufficiently heated atmosphere. Since the operation, however, both lower extremities have perspired freely and frequently—more than would naturally be expected, in fact.

As to the probable final outcome of this most interesting case the gentlemen of this Section will all be able to speak with greater authority than myself, and I shall hope to profit by their expression of opinion.

A few words now upon some general considerations.

There are so few recorded cases in which the operation under discussion has been done for traumatic paraplegia that each case almost stands alone in its own part of the spine, and there is very little with which to compare it, either in technique or result.

It is, of course, absurd to expect a brilliant outcome in these fracture cases—a result which, however, experience has shown to be abundantly possible where tumor is the

cause of the paraplegia. In most cases of spinal fracture, with resulting paralysis below, the original injury to the cord has been so severe, the laceration of the cord by the broken bones so great, that even where pressure can be demonstrated and it is removed by surgical means at once, this relief only makes an ultimate recovery possible : it does not at all make it probable.

Still, when it is demonstrated that the cord can safely be exposed, that in a case of traumatic paraplegia the operation for relief of bony pressure becomes by care and asepsis even approximately as safe as one for a traumatic hemiplegia from depressed bone in the skull, then the surgeon will not be considered free from responsibility who withholds his hand.

Each new case, whether successful or otherwise, should be recorded at once, to stand as a guide-post or a warning on our path in these recent domains of surgery.

It seems to the writer that we may now advance the following statement as a rule of practice :

Whenever, following traumatism, even a slight abrupt irregularity of the spinal column is observed to coexist with paraplegia from this level, a cutting operation is indicated to determine whether the paralysis is not, by bony pressure, made incapable of spontaneous relief.

This operation should be deferred no longer than recovery from the original shock of the injury demands. If needed at all, it is needed early ; and we make a mistake if, as in my case, we wait until electricity and time have alike proved futile before attempting what I may call exploratory resection. It will be the easier by far to the surgeon at this early stage, and the safer for the patient, at least when the obvious displacement is due to a broken posterior arch, as then comparatively little bony section would be needed, the fragments not having become consolidated by bony union in their false position.

Possibly it might be best to do this, too, even in cases (almost always cervical) in which a simple dislocation is present. Here we have the widest difference of opinion among able men. Most surgeons advocate attempts at

reduction by pressure, with or without accompanying extension of the spinal column. Others, who have had one or more patients die suddenly during such manipulations, say "Hands off." May it not be true that in dislocation with paraplegia the removal of one or more arches would, by relieving the cord, be our safest and therefore wisest expedient? When attempted, the "H" incision would seem best, permitting as it does the several laminae to reunite, in those cases where no pressure is discovered.

Nothing is more hopeless in medicine than paraplegia from bony pressure. If this condition were even deemed a strong possibility, operation seems to the writer indicated. This is really in the line of conservatism, since that is wise conservatism which, by whatever means, best conserves or prolongs the patient's life.

If in cases of this kind, although not curing the mangled cord, we shall relieve to a notable extent the patient's sufferings, making his life more endurable and prolonging it, our treatment is more than justified.

It is now February 1st, 1890, nearly a year since the date of operation which I have described. It may interest those who have followed the history of this case to know how the patient now is. Accordingly I publish below a letter recently received from him, which tells its own tale.

While I strongly doubt if he ever recovers fully his lost powers, and do not take so hopeful a view of the future as he seems to do, yet it must be evident to us all what a contrast is herein shown. On the one hand, a pain-racked, bed-ridden paraplegic, steadily failing in all respects. On the other, the same man capable of being up and about, going driving, free from pain, and getting some enjoyment out of an existence indefinitely prolonged.

SING SING, N. Y., P. O. Box 402, {
December 14th, 1889. }

DR. DAWBARN,

My Dear Doctor.—You ask me for a report upon my present state of health. In giving this, let me go back a little.

February 27, 1889, the operation was performed by you, after much kindly work, interest and attention, for which I am also deeply indebted to Dr. Gray. After recovering from the ether, I found I could move my head without the sharp pains I had experienced before the operation. In a week's time I felt like another person, as far as the pain from the fractured bone pressing on the spinal cord was concerned. My appetite improved, and I became stronger in every way. After a little the battery was again applied. Before the operation, where I could stand one hundred cells, now I could barely stand forty cells. We, now if you remember, tried the faradic battery, and found we could get a better and more vigorous response to the muscles that would only respond to the galvanic battery before the operation, and some muscles that would not respond at all responded now quite vigorously. Under the daily application of the battery and massage treatment I improved in every way, the feeling gradually began to creep down, my bowels became stronger, so that in a short time I could tell when I wanted to have a passage, also when my bladder was full. My legs now picked up in flesh, and muscles became harder and more prominent, and at present time, December 14, 1889, are as large as ever they were and of a good healthy color. Before the operation they had wasted away to nothing but skin and bones.

I soon began to get control of the inside muscles of my legs, also to get stronger through the hips; and when I drew a long breath, I could draw my stomach in, something I had been unable to do before. I continued to gain, so that in ten weeks from date of operation I could sit up eight and ten hours a day without the least pain. June 23, 1889, I came up in the country again, when I commenced to ride out every pleasant day in a phaeton, driving for myself. At the present time I can ride twenty to twenty-five miles without becoming fatigued, sometimes being in the phaeton six and eight hours. Now, when lying on either side, I can voluntarily lift one leg over the other, viz., if on left side, I lift the right leg over the left; *vice versa*; also, when lying on my back, can draw my right leg up so

that my knee is four inches clear of the bed. Have been stood upon my feet, and find I can bear most of my weight on my legs without my knees bending. The feeling on back part of my body is down to the second lumbar, on front part about six or seven inches below the hip-joint. When applying the battery, can feel the cords in any part of my legs contract; also know when the bone is being squeezed. My toe-nails on both feet grow as vigorously as a well person's. I have no bed-sores any more, and my water is clear. Blood circulates fairly well. And I sincerely believe it is only a matter of time before I shall walk again; which I never would have done had not the operation been performed, but would have been numbered with the dead.

Sincerely yours, etc.,

HAROLD SARLES.

To Robert H. M. Dawbarn, M.D.

P. S.—If you care to publish this report with my name and address do so, and I should be glad to answer any inquiries.

